as part of its operational plans.

D. Scope of Rules

1. Non-U.S.-Licensed Space Stations

92. *Background.* The FCC has adopted procedures to facilitate provision of satellite services in the United States using space stations licensed by Administrations other than the United States pursuant to the commitments of the United States under the World Trade Organization (WTO) Agreement on Basic Telecommunications Services (WTO Telecom Agreement) and the General Agreement on Trade in Services (GATS).[234] Such non-U.S.-licensed space stations[235] can provide service to earth stations located in the United States through the provisions outlined in Section 25.137 of the Commission's rules.[236] A party following this procedure must submit the same technical information concerning the space station involved as is required to be submitted by U.S. space station license applicants.[237] The *Orbital Debris Notice* proposed to require submission of debris mitigation plans as part of such submissions of technical information.[238] In addition, the *Notice* sought comment on whether it should be deemed sufficient for non-U.S.-licensed space station operators to submit evidence that the satellite system's debris mitigation plans are subject to direct and effective regulatory oversight by the satellite system's national licensing authority, and on the proper scope of any such showing.[239]

93. *Discussion.* We conclude that the public interest is served by requiring entities that request a Commission ruling for access to a non-U.S.-licensed space station to serve the U.S. market to submit the same information concerning the orbital debris mitigation plans of the non-U.S-licensed space station as that submitted by U.S.-licensed space stations. As we observed in the *Orbital Debris Notice*, some consideration of whether a space station serving the United States will employ reasonable debris

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[234] The WTO came into being on January 1, 1995, pursuant to the Marrakesh Agreement Establishing the World Trade Organization (the Marrakesh Agreement). 33 I.L.M. 1125 (1994). The Marrakesh Agreement includes multilateral agreements on trade in goods, services, intellectual property, and dispute settlement. The GATS is Annex 1B of the Marrkesh Agreement. 33 I.L.M. 1167 (1994). The WTO Telecom Agreement was incorporated into the GATS by the Fourth Protocol to the GATS (April 30, 1996). 36 I.L.M. 354 (1997).

[235] The term "non-U.S.-licensed space station" refers to a space station that is authorized by a country other than the United States, and for which the United States is not the administration that has assumed responsibility for notification, coordination, and other relevant matters under the ITU Radio Regulations. *See Orbital Debris Notice*, 17 FCC Rcd at 5599 n.74.

[236] 47 C.F.R. § 25.137. The Commission's foreign entry framework was adopted in the *DISCO II* proceeding. *See Amendment of the Commission's Regulatory Policies to Allow Non-U.S. Licensed Satellites Providing Domestic and International Service in the United States*, Report and Order, IB Docket No. 96-111, FCC 97-399, 12 FCC Rcd 24094 (1997) (*DISCO II Order* or *DISCO II*), *recon.* 15 FCC Rcd 7207 (1999) (*DISCO II First Reconsideration Order*), *recon. denied* 16 FCC Rcd 19794 (2001) (*DISCO II Second Reconsideration Order*). For a detailed summary of the *DISCO II* framework, we refer the reader to the *DISCO II First Reconsideration Order*, 15 FCC Rcd at 7209-10 (paras. 4-5).

[237] Until recently, operators of non-U.S.-licensed space stations were not required to submit certain technical information concerning the satellite if they had completed international coordination. *See DISCO II Order*, 12 FCC Rcd at 24175 (para. 189). As part of our Space Station Licensing Reform proceeding, however, we concluded that, in order to better determine whether a non-U.S.-licensed space station meets the Commission's technical requirements, non-U.S.-licensed space station operators seeking access to the U.S. market must provide the same information as U.S. satellite license applicants, regardless of whether they have completed international coordination. *See First Report and Order*, 18 FCC Rcd at 10872 (para. 300).

[238] *Orbital Debris Notice*, 17 FCC Rcd at 5611.

[239] *Id.* at 5611-12.

mitigation measures is appropriate, regardless of the licensing Administration, in order to ensure that the satellite communications activity that we authorize does not involve substantial safety concerns or activities that may be detrimental to space operations.[240] Most importantly, a categorical exemption for any class of satellites serving the United States would undermine the legitimate public policy objective of mitigating orbital debris, and thereby promoting continued affordable access to space, continued provision of reliable space-based services, and the safety of persons and property in space and on the surface of the Earth.

94. By requiring entities that request Commission approval to access the U.S. market via non-U.S.-licensed space stations to submit technical information concerning orbital debris mitigation, we are simply ensuring that foreign operators that seek access to the U.S. market for commercial reasons meet the same public interest requirements as U.S.-licensed operators. As comments point out,[241] this approach comports with our policy of requiring non-U.S. satellite operators to submit the same type of technical information that we require of U.S. space station licensees.[242] We observe that orbital debris mitigation plans are not unique in this regard, but are like a number of technical regulatory policy areas, such as compliance with FCC two-degree spacing policies, in which we seek technical information about non-U.S.-licensed space station systems relevant to the authorization of earth station operations in the United States.[243] Our review of the debris mitigation plans of all systems, whether involving U.S.-licensed or non-U.S.-licensed space stations, will be based on objective and transparent criteria set forth in this proceeding that have been designed to be no more burdensome than necessary to protect the public interest in mitigating orbital debris. Furthermore, these criteria have been developed in a manner consistent with the recommendations of international organizations, such as the ITU, which has recommended orbital debris mitigation measures since at least 1993.[244] Accordingly, we have no reason to believe that non-U.S.-licensed space stations will have any greater difficulty complying with our debris mitigation disclosure requirements than U.S.-licensed space stations.

95. Regarding the nature of the proposed debris mitigation showing by non-U.S.-licensed space stations, we conclude that the disclosure requirement can be satisfied by showing that the satellite system's debris mitigation plans are subject to direct and effective regulatory oversight by the satellite system's national licensing authority. This conclusion is supported by those parties that submitted comments on this question.[245] One method of making this showing is to submit an English language version of the debris mitigation rules or regulations of the national licensing authority and to indicate the current status of the national licensing authority's review of its debris mitigation plans.

96. We do not agree with comments that claim that requiring a non-U.S.-licensed space station to submit its orbital debris mitigation plan constitutes a "unilateral" or "extraterritorial" imposition of Commission rules.[246] Our review of orbital debris mitigation plans of non-U.S.-licensed space stations

[240] *Id.* at 5600, 5611.

[241] SIA Comments at 18; SES Americom Reply at 7.

[242] We note that the Commission has previously found that requiring prospective foreign entrants to meet the same qualification requirements, including technical requirements, that apply to U.S. applicants is consistent with the United States' obligations under the GATS. *See DISCO II Order*, 12 FCC Rcd at 24163.

[243] *See Orbital Debris Notice*, 17 FCC Rcd at 5611.

[244] As noted previously, the ITU, a specialized agency of the United Nations, has adopted a recommendation for the disposal of GEO space stations and has revised this recommendation to closely comport with the disposal guidelines proposed by the IADC. *See supra*, note 43.

[245] SIA Comments at 18; UM Space Law Center Comments at 4.

[246] Telesat Comments at 9.

applies only to those non-U.S. space station operators that for commercial reasons request to provide service to the U.S. market. As observed in the *Notice*,[247] this review does not give the Commission any ability to take direct enforcement action concerning a non-U.S. licensed space station; rather, Commission actions are limited to withholding or withdrawal of authority of U.S.-licensed earth stations to communicate with non-U.S.-licensed space stations. Thus, our review of debris mitigation plans as part of requests for Commission authorization in no way expands our existing authority regarding the ability of non-U.S.-licensed space stations to serve the U.S. market.

97. To the extent that our policy leads other countries to adopt orbital debris mitigation requirements of their own, as Telesat suggests,[248] we believe such a development would be desirable and fully consistent with our overall goal of mitigating orbital debris.[249] Because the debris mitigation rules that we adopt herein are consistent with the consensus recommendations of international institutions and the leading space-faring nations,[250] we anticipate that measures for mitigating orbital debris that may be adopted by other countries are likely to be consistent with those measures we adopt today.[251] Furthermore, although Telesat suggests that other nations may use orbital debris mitigation rules as a means to prevent entry of foreign satellite service providers,[252] we do not believe that the theoretical possibility that other countries could take ill-considered actions, at variance with international norms, in any way should prevent the Commission from adopting objective and transparent measures concerning orbital debris mitigation that serve that public interest.

2. Amateur and Experimental Licensees

98. *Background.* The Commission's rules include provisions in Parts 97 (amateur) and 5 (experimental) concerning satellites. The *Orbital Debris Notice* observed that amateur and experimental spacecraft can present the same public interest concerns as operations under other rule parts.[253] As a result, the *Notice* proposed to amend Parts 5 and 97 to require amateur and experimental space station licensees to submit the same disclosure regarding orbital debris mitigation plans as that submitted by operators subject to Part 25.[254] Specifically, the *Orbital Debris Notice* proposed to amend the texts of Sections 5.63 and 97.207(g) of the Commission's rules to require experimental and amateur satellite licensees to submit a description of the design and operational strategies that will be used to mitigate orbital debris – including a casualty risk assessment if planned post-mission disposal involves atmospheric re-entry of a spacecraft – and to demonstrate that debris generation will not result from the

[247] *Orbital Debris Notice*, 17 FCC Rcd at 5611.

[248] Telesat Comments at 9.

[249] To the extent that our actions provide incentive for other spacefaring nations to adopt comparable orbital debris mitigation measures for their commercial satellite operators, our actions are consistent with the policy expressed in the 1996 National Space Policy, which states that it is in the interests of the U.S. Government to ensure orbital debris mitigation practices are applied by other spacefaring nations and international organizations.

[250] In this respect, Telesat's desire that we rely on debris mitigation measures developed through an international process appears to have been addressed.

[251] Furthermore, as the Commission has previously found, the chance that other countries may adopt licensing requirements for U.S. satellite operators seeking to provide service in that country is, on balance, a minimal burden when compared to the possibility that unrestricted entry by foreign-licensed satellites would vitiate our orbit efficiency policies. *See DISCO II Order*, 12 FCC Rcd at 24163.

[252] Telesat Comments at 9.

[253] *Orbital Debris Notice*, 17 FCC Rcd at 5612.

[254] *Id.* We also proposed to update references in the current rules to ITU documents concerning space station notifications, so that those references reflect current ITU documents. *See id.* at n.109.

conversion of energy sources on board the spacecraft into energy that fragments the spacecraft.[255]

99. *Discussion.* No comments oppose requiring amateur service and experimental radio service licensees to disclose their orbital debris mitigation plans as part of their applications for Commission authorization. We also note that AMSAT states that a disclosure requirement can be met by builders of amateur radio satellites.[256] For these reasons, we adopt our proposal to amend Sections 5.63 and 97.207(g) of the Commission's rules to require amateur service and experimental satellite licensees to submit a description of the design and operational strategies that will be used to mitigate orbital debris as part of their applications for Commission authorization. We will review the debris mitigation disclosures of amateur service and experimental space station licensees on a case-by-case basis to determine whether the licensee's proposed system will be consistent with requirements and policies adopted in this Second Report and Order, including measures for the post mission disposal of spacecraft. To the extent the information disclosed raises operational or orbital debris mitigation concerns, the Commission may seek further information, condition the authorization, or withhold approval, as necessary.

100. Some comments argue that either a temporary or permanent exception is warranted for amateur service space stations because of the allegedly high cost of compliance with mitigation requirements and the limited resources of amateur radio operators.[257] Other comments indicate that amateur service space station licensees should be exempt from such requirements because the amateur service has played an important role in the development and use of satellite technologies.[258] We decline to exempt amateur service space stations categorically from any need to address orbital debris mitigation because some amateur service space stations in low Earth orbit have expected post-mission orbital lifetimes that exceed the 25 year time period recommended by the U.S. Government Standard Practices and the IADC guidelines[259] and because the long orbital lifetimes of such amateur service satellites increases the probability that collisions between objects will occur thereby resulting in more orbital debris. For these reasons, we believe amateur service space stations pose the same public interest concerns with regard to orbital debris as space stations subject to other parts of our rules. We recognize that because most amateur service space craft are LEO spacecraft, post-mission disposal requirements may necessitate modifications in the current design and operation, either through the addition of propulsion systems or other strategies to cause a spacecraft to re-enter the Earth's atmosphere within 25 years of end of life, or by foregoing operations at higher orbital altitudes where the effects of atmospheric drag are not sufficiently strong by themselves to remove the space station from orbit within this 25-year time period. We believe, however, that the costs involved with these modifications are justified when

[255] *Id.*, Appendix B [Proposed Rule Changes].

[256] AMSAT Comments at 10.

[257] Leggett Comments at 2-3; Ecliptic Comments at 11-12 (stating that amateur and experimental licensees are the "most cost constrained" class of licensees); AMSAT Comments at 6-8; AMSAT Reply at 5 (stating that compliance with debris mitigation rules could impose costs on amateur satellite operations, either through the additional cost of adding propulsion systems to amateur space stations or through a reduction of the visible "footprint" of a propulsion-less satellite by restricting its operations to lower altitudes from which it will re-enter the Earth's within 25 years).

[258] Ecliptic Comments at 12-13.

[259] For example, the "Quakesat" microsatellite that was launched in June 2003 is expected to have an orbital lifetime of more than 41 years. This lifetime is derived using the NASA Orbital Debris Assessment Software (DAS version 1.5), which is available at http://www.orbitaldebris.jsc.nasa.gov. It is based on an orbit with apogee of 833 kilometers and perigee of 817 kilometers and on an area-to-mass ratio of 0.0542 m^2/kg (0.1626 m^2/3kg). The orbital characteristics of the Quakesat are published in NASA Satellite Situation Report, Volume 44, Number 9 (September 30, 2003). The nominal operational lifetime for Quakesat has been estimated at one year. *See* Quakesat website, which is available at http://www.quakefinder.com/quakesat.

balanced against the public interest in mitigating orbital debris.

101. Recently, AMSAT filed a proposal to modify the notification procedures for the licensing of amateur service satellites.[260] Our licensing rules for amateur service satellites currently require a license grantee of an amateur service space station to make written notifications of its proposed operations to the International Bureau prior to commencing operations. The first of these written notices is required no less than 27 months prior to initiating space station transmissions and must provide the technical characteristics of the space station required by Appendix 4 and Resolution No. 642 of the ITU Radio Regulations.[261] The second notice is required no less than five months prior to the initiation of space station transmissions and must provide the information regarding spurious emissions required by Appendix 3 and Resolution No. 642 of the ITU Radio Regulations.[262] AMSAT proposes to change the written notification requirements to provide for shorter notification periods and more streamlined information requirements.[263] The current notification periods, if followed by amateur applicants,[264] should generally provide sufficient time for Commission staff to review the orbital debris mitigation plans of amateur space stations prior to their launch and operation and should provide adequate time for applicants to correct any deficiencies revealed as a result of this review. We have recently commenced a rulemaking proceeding to consider proposals to shorten or otherwise alter the licensing process for amateur space stations.[265] As part of this rulemaking, we have sought comment on what actions the Commission should take if it is presented with an orbital debris mitigation plan that raises concerns as to the debris mitigation practices of an amateur service space station, as well as on any alternative licensing processes that may help us to evaluate whether the launch and operation of particular amateur space stations are consistent with the public interest.[266]

3. NOAA-Licensed Space Stations

102. *Background.* As described in the *Orbital Debris Notice*,[267] commercial remote sensing satellites are subject to regulation by both National Oceanic and Atmospheric Administration (NOAA) and the FCC. The Land Remote Sensing Policy Act of 1992 (Remote Sensing Act)[268] designated the Secretary of Commerce as the U.S. licensing authority for commercial remote sensing systems. Because

[260] *See* Radio Amateur Satellite Corporation Petition For Rule Making (filed December 2, 2002) (AMSAT Petition). The petition was placed on public notice on December 18, 2002. *See Public Notice*, Report No. 2589 (rel. Dec. 18, 2002).

[261] 47 C.F.R. § 97.207(g)(1).

[262] 47 C.F.R. § 97.207(g)(2).

[263] AMSAT Petition at 2 (proposing amending section 97.202(g) to provide for a single notification to the International Bureau 30 days after the amateur licensee obtains a launch commitment for the satellite and to limit the information provided to that described in Appendix 4 of the ITU Radio Regulations).

[264] We note that it is our experience that amateur space station licensees have not consistently submitted notifications to the Commission in the timely manner set out by Section 97.207(g).

[265] *Amendment of Part 97 of the Commission's Rules Governing the Amateur Radio Services*, Notice of Proposed Rulemaking, WT Docket No. 04-140, FCC 04-79, 19 FCC Rcd 7293 (paras. 73-77) (2004) (proposing, among other things, to require that pre-space notification be submitted within 30 days after the launch vehicle used to launch the amateur space station is determined, but no later than 90 days before the space station is integrated into the launch vehicle).

[266] *See id.* at para. 77.

[267] *Orbital Debris Notice*, 17 FCC Rcd at 5592.

[268] 15 U.S.C. § 5601 *et seq.*

commercial remote sensing satellites use radio frequencies to transmit data collected in space back to Earth, commercial remote sensing satellites typically must also obtain a separate license from the FCC pursuant to the Communications Act for the spectrum usage.[269] Thus, commercial remote sensing satellites hold NOAA licenses regarding the operation of the satellite, such as provisions regarding the resolution of the imagery, as well as from the FCC regarding spectrum use.

103. The Remote Sensing Act requires that a licensee "upon termination of operations under the license, make disposition of any satellites in space in a manner satisfactory to the President."[270] NOAA has interpreted this requirement to mean that a licensee shall assess and minimize the amount of orbital debris released during the post-mission disposal of its satellite.[271] Accordingly, NOAA requires applicants subject to its jurisdiction to provide, at the time of application for NOAA authorization, a plan for the post-mission disposal of remote sensing satellites, which is reviewed on a case-by-case basis.[272] Because NOAA already examines the post-mission disposal of remote sensing satellites, the *Orbital Debris Notice* tentatively concluded not to address matters involving post-mission disposal of NOAA-licensed satellites as part of its examination of the debris mitigation disclosures of remote sensing satellites.[273]

104. *Discussion.* We adopt the proposal of the *Notice*. There is no additional benefit to reviewing the post-mission disposal plans of commercial remote sensing satellite applicants when such plans are already subject to effective regulatory review by NOAA. Accordingly, to the extent that a remote sensing satellite applicant has submitted its post-mission disposal plans to NOAA for review and approval, we will not require submission of such information. Nonetheless, with respect to elements of debris mitigation other than post-mission disposal, and for which NOAA has not received information necessary for review and approval, we will require FCC remote sensing satellite applicants to submit such information as part of an application for Commission authority, and will review any such aspects of a remote sensing applicant's debris mitigation plans that are outside the scope of NOAA review.[274]

4. Launch Vehicles

105. *Background.* In the *Orbital Debris Notice*, the Commission sought comment on whether there are any matters involving launch vehicles that the FCC has authority to consider as part of its review of an orbital debris mitigation disclosure.[275] The *Notice* observed that Congress appointed the Department of Transportation to be the U.S. licensing authority for commercial launch operators pursuant to the Commercial Space Launch Act of 1984, as amended,[276] and that the Department of Transportation,

[269] 15 U.S.C. § 5625(e) (stating that Remote Sensing Act does not affect the authority of the FCC concerning the licensing of satellites transmitting radio communications).

[270] 15 U.S.C. § 5622(b)(4).

[271] *Licensing of Private Land Remote-Sensing Space Systems*, Interim Final Rule, 65 Fed. Reg. 46822 (July 31, 2000).

[272] *Id.*

[273] 15 U.S.C. § 5601 *et seq.* The Land Remote Sensing Policy Act requires that a licensee, "upon termination of operations under the license, make disposition of any satellites in space in a manner satisfactory to the President." *See id.* § 5622(b)(4).

[274] Should NOAA elect to receive and approve the orbital debris mitigation plans of remote sensing satellite applicants beyond post-mission disposal, we would consider waiver of our review of those elements already approved by NOAA.

[275] *Orbital Debris Notice,* 17 FCC Rcd at 5600.

[276] 49 U.S.C. § 70101 *et seq.*

through a delegation of authority to the Federal Aviation Administration, has already adopted detailed launch safety requirements that include measures to mitigate orbital debris and regulations requiring launch liability insurance.[277] The Commission has not required applicants for FCC space station licenses to submit information regarding debris mitigation plans for the launch vehicle that will be used to launch the space station, nor have we reviewed this information even if it is submitted.[278] The *Notice* did not propose to change this practice, but rather observed that matters addressed under the Commercial Space Launch Act and its implementing regulations are most appropriately addressed by the FAA.[279]

106. The *Orbital Debris Notice* inquired, however, whether the Commission would have the authority to consider launch-related matters that appear to be outside the scope of the Commercial Space Launch Act and FAA jurisdiction. For example, although FAA authorization is required for all launches from U.S. territory and for launches by U.S. citizens outside the United States,[280] the FAA does not regulate launches by non-U.S. citizens outside the United States. In the case where a company is seeking a FCC license and procuring its launch from a launch provider that is not subject to FAA jurisdiction, we sought comment on whether the Commission could consider orbital debris issues involving the launch vehicle used to launch the satellite system, if asked to do so.[281]

107. *Discussion.* Arianespace, a non-U.S. provider of launch services, opposes any consideration of launch vehicles as part of the Commission's licensing process. It asserts that the Commission lacks statutory authority under either the Commercial Space Launch Act or the Communications Act to consider matters relating to launch vehicles.[282] Arianespace also claims that FCC consideration of matters related to non-U.S. launch vehicles would constitute an extraterritorial and unilateral extension of FCC authority, which would undermine negotiations conducted by U.S. Executive branch agencies in multilateral bodies, such as the IADC and UNCOPOUS.[283] Finally, Arianespace argues that submitting non-U.S. launch vehicles to the Commission's debris mitigation requirements would subject non-U.S. launch providers to duplicative and dual regulation, since Arianespace claims that it will be subject to the debris mitigation regulations of France and the European Space Agency.[284] Even if the Commission adopts orbital debris mitigation rules similar to those imposed by other nations, Arianespace asserts that a non-U.S. launch provider would still incur additional costs by having to participate in the Commission licensing process on behalf of its customer and would face the market uncertainty of whether its orbital debris mitigation plans are acceptable to the Commission.[285]

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[277] *Orbital Debris Notice*, 17 FCC Rcd at 5592-93. The FAA's implementing regulations are codified at 14 C.F.R. Ch. III, § 400 *et seq*. The FAA's authority over payloads does not extend to payloads subject to regulation by the FCC or NOAA, and the FAA's authority does not cover space activities conducted by and for the U.S. Government. *See* 49 U.S.C. § 70117(b) and (g).

[278] *Orbital Debris Notice*, 17 FCC Rcd at 5600 (citing *The Boeing Company*, Order and Authorization, DA 01-1631, 16 FCC Rcd 13691, 13704(para. 33) (2001)).

[279] *Id.*

[280] 49 U.S.C. §§ 70102 and 70104. Section 70102(1) of the Commercial Space Launch Act defines "citizen of the United States" to mean: "(A) an individual who is a citizen of the United States; (B) an entity organized or existing under the laws of the United States; or (C) an entity organized or existing under the laws of a foreign country if the controlling interest...is held by an individual or entity described in subclause (A) or (B). . . ."

[281] *Orbital Debris Notice*, 17 FCC Rcd at 5600.

[282] Arianespace Comments at 3.

[283] *Id.* at 4-5.

[284] *Id.* at 6.

[285] *Id.* at 7-8.

108. We see no reason to alter our current practice of not requiring information about the launch vehicle used to launch a Commission-authorized space station into orbit. We agree with Arianespace that it is highly unlikely that there would be any significant public interest concerns regarding orbital debris that would arise from the use of a particular launch vehicle due to the highly regulated nature of the launch industry, both within the United States and abroad,[286] and the active participation of the launch vehicle industry in the formulation of debris mitigation measures. We disagree with Arianespace, however, that the Commission lacks the authority to address these concerns, insofar as they involve a non-U.S. licensed launch provider, should they be brought to our attention in a specific space station licensing case. The Communications Act requires the Commission to ascertain that the grant of an authorization to construct, launch and implement a space station serves the public interest and makes no exemption or distinction for public interest concerns related to the launch vehicle used as part of the launch of that space station. While we do not anticipate that we will need to consider such concerns due to the commitment of the launch industry, and of a wide range of responsible authorities in the major space-faring nations, to mitigate orbital debris, we retain the discretion to consider such concerns in the event that they are brought to our attention as part of a request for Commission authorization of a particular space station. For example, commenters observe that upper stages of launch vehicles sometimes carry secondary payloads and experiments that are designed not to separate from the upper stage, including amateur radio satellites.[287] In such a case, the upper stage of the launch vehicle effectively becomes part of the space station that is seeking Commission authorization to operate. To the extent that the debris mitigation disclosure certifies that the debris mitigation plans of the launch vehicle upper stage have been, or will be, reviewed by the FAA, no further FCC examination of the debris mitigation plans of the upper stage will be required. We anticipate that the same deference will be extended to entities who demonstrate that the debris mitigation plans of the utilized upper stage are subject to direct and effective regulatory control by another national regulatory agency and the entity certifies that the upper stage will conform to the orbital debris mitigation practices adopted by the national regulatory agency.

E. Liability Issues and Insurance

109. *Background.* The *Orbital Debris Notice* sought comment on the role that liability considerations and insurance should play in decisions regarding debris mitigation measures. As observed in the *Notice*,[288] the United States is party to two international treaties that address liability arising from activities in outer space.[289] The Outer Space Treaty requires that State Parties bear international responsibility for national activities in space, whether carried out by governmental agencies or non-governmental entities.[290] Article VII of the Outer Space Treaty provides that, "Each State Party to the Treaty that launches or procures the launching of an object into outer space ... is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space, including the Moon and other celestial bodies."[291] The definition of "space object" includes "component parts of a space object" and thus may, at least arguably, incorporate orbital debris resulting from satellite operations. The Convention on International Liability for Damage Caused by Space Objects (Liability Convention) elaborates on Article

[286] *Id.* at 7 (observing that Arianespace launch vehicles are subject to debris mitigation guidelines promulgated by France's Centre National des Études Spatiales (CNES) and the European Space Agency (ESA)).

[287] AMSAT Comments at 5.

[288] *Orbital Debris Notice*, 17 FCC Rcd at 5595.

[289] Full text of the U.N. treaties are available on-line at http://www.oosa.unvienna.org/SpaceLaw/treaties.html.

[290] Outer Space Treaty, Article VI.

[291] Outer Space Treaty, Article VII.

VII of the Outer Space Treaty and provides that a "launching state shall be absolutely liable to pay compensation for damage caused by its space objects on the surface of the Earth or to aircraft flight."[292] In the event of damage being caused elsewhere than on the surface of the Earth to a space object of one launching State or to persons or property on board such a space object by a space object of another launching State, the Liability Convention states that the launching state "shall be liable only if the damage is due to its fault or the fault of persons for whom it is responsible."[293] A "launching state" is defined as either (1) a State which launches or procures the launching of a space object, or (2) a State from whose territory or facility a space object is launched.[294]

110. Accordingly, under international law, the United States government could potentially be presented with a claim under the Liability Convention for certain damage that may result from private space station operations, including disposal, maneuvering, and the generation of orbital debris. Congress has adopted a comprehensive statutory regime to address liability issues arising from the launch of spacecraft by private entities.[295] Under that statute, the FAA requires its launch licensees to obtain insurance for potential liability to third parties resulting from launch mishaps.[296] These insurance requirements do not, however, address post-launch issues arising from damages caused by a space station payload after a nominal launch is concluded.[297] The *Notice* sought comment on whether there are circumstances in which Commission-licensed space stations should be required to obtain insurance in order to protect the United States and its taxpayers from exposure to third-party liability arising from orbital debris, or in order to provide economic incentives for operators to adopt debris mitigation strategies that reduce risk and lower insurance premiums.[298] The *Notice* also sought comment on whether different types of risk may differ with respect to whether they can be appropriately addressed through insurance, as well as the Commission's authority to require such insurance.[299]

111. *Discussion.* We agree with comments that state that there may be cases where requiring operators to obtain insurance would not be unreasonable given the potential risk assumed by the U.S. government under international law, and that insurance can, in some instances, provide an economic incentive for operators to undertake debris mitigation measures.[300] We have found in the past that the existence of insurance policies to address orbital debris risks was a relevant public interest factor in approving an applicant's plans to dispose of its space stations at the end of life by means of atmospheric re-entry.[301] SIA agrees that insurance requirements may be necessary with respect to satellites that will be disposed of through atmospheric re-entry, since there is a potential risk of damage and insurance has proven to be available in the past for such disposal.[302] We anticipate that insurance and liability issues

[292] Liability Convention, Article I.

[293] Liability Convention, Article II.

[294] Liability Convention, Article I.

[295] Commercial Space Launch Act of 1984, as amended, 49 U.S.C. § 70101 *et seq.*

[296] 14 C.F.R. § 440.1 *et seq.*

[297] Under FAA regulations, third-party liability insurance is required to remain in effect only for 30 days after the later of vehicle ignition or payload separation. *See* 14 C.F.R. § 440.11.

[298] *Orbital Debris Notice*, 17 FCC Rcd at 5611.

[299] *Id.*

[300] UM Space Law Center Comments at 5.

[301] *See Space System Licensee, et al.*, Memorandum Opinion, Order and Authorization, DA 02-307, 17 FCC Rcd 2271 (Int'l Bur. 2002).

[302] SIA Comments at 17.

will continue to play a role in the determination of whether approval of a particular debris mitigation plan serves the public interest, particularly when the plan involve activities such as atmospheric re-entry, which may involve more immediate and substantial risks to persons and property on the surface of the Earth.

112. With respect to other potential activities that might be the subject of any insurance requirement, we indicated in the *Notice* that debris objects have potentially very long orbital lifetimes.[303] Those lifetimes may range into the hundreds or thousands of years. Thus, the period for insurance coverage against damage caused by orbital debris may exceed the period of time typically covered by commercially available insurance policies. We conclude that such risks are not ones that may be addressed through insurance requirements. As for risks that occur during the normal operation of the space station, comments indicate that many operators already obtain insurance for such operations.[304] We decline to adopt a specific requirement with regards to insurance for such normal operations, but note that in specific cases the existence of, or availability of, insurance may be considered as a factor in our public interest determinations.

113. With respect to liability issues, we stress that our examination of debris mitigation and post-mission disposal plans is restricted to an inquiry as to whether a space station operator has taken debris mitigation measures into account during the design and operation of its spacecraft and as to whether such designs and operations might raise obvious public interest concerns. Our review of an applicant's debris mitigation plan, or a grant of authority to dispose of a space station at the end of life, does not address, nor is it intended to alter, any liability of the space station applicant or any other private company in connection with the commissioning, operation, or de-commissioning of its satellite system.[305]

F. Other Matters

114. *Background.* In response to the *Orbital Debris Notice*, certain proposals were made in addition to those raised by the *Notice*. In particular, Slabinski proposes that space station licensees in the geostationary-Earth orbit be required to post a one-million dollar bond per space station to the FCC or some other agency before launch, which would be refunded only after the space station is disposed at end of life to a proper disposal orbit.[306] The bond amount would be forfeited if the space station is not properly disposed of at end of life, or the amount would be returned on a pro-rated basis if the actual disposal orbit was raised only part way to the minimum required disposal orbit.[307] Slabinski argues that the posting of such a bond would provide additional economic incentive to space station licensees to ensure that their space stations are properly disposed of at the end of life. In addition, Slabinski urges adoption of a requirement that all space station licensees should procure and maintain comprehensive, up-to-date and readily available documentation that explains the spacecraft idiosyncrasies and end-of-life maneuver procedures.[308] This documentation would include reports of all operational anomalies.[309] Although Slabinski does not expressly state the purpose of this documentation, it can be inferred that it

[303] *Orbital Debris Notice*, 17 FCC Rcd at 5611.

[304] AON Space Comments at 4-5.

[305] *See Space System Licensee, et al.*, 17 FCC Rcd at 2291 n.132.

[306] Slabinski Comments at 1.

[307] *Id.*

[308] *Id.* at 3.

[309] *Id.* Slabinski also urges that this documentation be maintained in paper form, given that technology is likely to change over the 15 years or more of a space station's functional lifetime, and electronic copies of documentation may not be readable by the end of a space station's life.

would be to preserve a record for the decisions made with regard to the post-mission disposal of a space station, which could occur a decade or more after launch.

115. *Discussion.* We decline at this time to impose a bond requirement for post-mission disposal of geostationary-Earth orbit satellites. Although we recently adopted a milestone performance bond requirement as part of the recent reform of our space station licensing procedures,[310] we do not find that a similar bond requirement is appropriate at this time with regard to post-mission disposal of GEO space stations. The rules that we adopt regarding post-mission disposal of Commission-licensed space stations should provide incentive for operators to dispose of their spacecraft at the end of life in a manner consistent with orbital debris mitigation objectives. Although we disagree with commenters that it would be prohibitively difficult to administer such a bond requirement,[311] we do not believe that the public interest would be served by requiring Commission licensees to post a bond which would not be returnable to the licensee for fifteen years or more, based on the current operational lifetimes of GEO communications satellites.[312] To the extent that Slablinski's proposal is intended to ensure that operators exercise their best efforts to properly perform end-of-life measures, we note that, if an operator fails to meet goals for proper end-of-life measures, the Commission has the authority to investigate the reasons for that failure, and take further regulatory measures, including enforcement action in appropriate cases.

116. We also decline to adopt additional document maintenance requirements for Commission space station licensees, as suggested by Slabinski. Slabinski has not provided any evidence to support the contention that space station licensees are not adequately maintaining records concerning their spacecraft, or that record maintenance is a direct influence on orbital debris creation or mitigation. Accordingly, we do not perceive any public interest benefit in adopting requirements regarding record retention and format of spacecraft documentation.

IV. CONCLUSION

117. Orbital debris mitigation measures are an important part of satellite operations in the public interest. Accordingly, we amend our rules to require disclosure of orbital debris mitigation plans as part of the technical information submitted pursuant to Section 25.114 of the Commission's rules. Specifically, a satellite system operator requesting FCC space station authorization, or an entity requesting a Commission ruling for access to a non-U.S.-licensed space station under our satellite market access procedures, must submit an orbital debris mitigation plan to the Commission regarding spacecraft design and operation in connection with its request. In addition, we provide guidance on the preparation of these plans and adopt post-mission disposal requirements for certain Commission-licensed space stations in the GEO and LEO orbital regimes. We will also initiate a further notice of proposed rulemaking to consider amending Section 25.210(j) to provide an explicit extension of an ±0.05° longitudinal tolerance to all Commission space stations, including MSS and remote sensing space stations. The actions that we take today will help ensure the continued affordable access to space, the continued provisions of reliable space-based communications services, and the continued safety of persons and property on the surface of the Earth.

[310] *First Report and Order*, 18 FCC Rcd at 10825 (para. 167).

[311] SES Americom Reply at 5 (arguing that a bond requirement raises numerous questions about the proper amount of any bond and how the Commission would determine whether the bond conditions have been satisfied).

[312] By contrast, the bond requirement adopted as part of our space station licensing reform is extent only for the relatively short period of time between licensing of the space station and the commencement of service via the licensed system. *See First Report & Order*, 18 FCC Rcd at 10825 (para. 167).

V. PROCEDURAL MATTERS

A. Final Regulatory Flexibility Act Analysis

118. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),[313] an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the *Orbital Debris Notice*.[314] The Commission sought written public comment on the proposals in the *Orbital Debris Notice*, including comment on the IRFA. The comments received are discussed below. Pursuant to the RFA,[315] a Final Regulatory Flexibility Analysis (FRFA) is contained in Appendix C.[316]

B. Final Paperwork Reduction Act of 1995 Analysis

119. This document does not contain new or modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. The Commission obtained OMB approval for the information collection requirements specified in the Second Report and Order. The OMB Control Number for the approved information collection is 3060-1013.

120. The Commission will send a copy of the Second Report and Order in a report to be sent to Congress and the General Accounting Office (GAO) pursuant to the Congressional Review Act, see 5 U.S.C. 801(a)(1)(A).

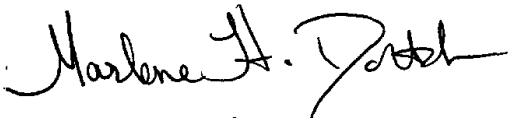
VI. ORDERING CLAUSES

121. Accordingly, IT IS ORDERED, pursuant to Sections 1, 4(i), 301, 303, 308, 309 and 310 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154(i), 301, 303, 308, 309 and 310, that this Second Report and Order in IB Docket No. 02-54 is hereby ADOPTED.

122. IT IS FURTHER ORDERED that Parts 5, 25 and 97 of the Commission's rules ARE AMENDED as set forth in Appendix B.

123. IT IS FURTHER ORDERED that the Consumer Information Bureau, Reference Information Center, SHALL SEND a copy of this Second Report and Order, including the Final Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION



Marlene H. Dortch
Secretary

[313] *See* 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601 – 612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

[314] *See Mitigation of Orbital Debris*, Notice of Proposed Rulemaking, IB Docket No. 02-54, FCC 02-80, 17 FCC Rcd 5586, 5613 (2002).

[315] *See* 5 U.S.C. § 604.

[316] *See* 5 U.S.C. § 604.

APPENDIX A – Parties Filing Pleadings

Comments

AON Space, Inc.
Arianespace Inc.
Ecliptic Enterprises Corp.
L'Garde, Inc.
Nickolaus E. Leggett
Orbcomm LLC
PanAmSat Corp.
Radio Amateur Satellite Corp. (AMSAT)
Satellite Industry Association (SIA)
Telesat Canada
University of Mississippi School of Law National Remote Sensing and Space Law Center (UM Space Law Center)
Victor J. Slabinski

Reply Comments

Radio Amateur Satellite Corp.
SES Americom, Inc.
Telesat Canada
Victor J. Slabinski

Late-Filed Comments & Ex Parte Communications

Boeing Company
EADS Astrium
EchoStar Satellite LLC
Inmarsat Ventures Ltd.
Intelsat Global Services Corp.
Iridium Satellite LLC
Massachusetts Institute of Technology Lincoln Laboratory (MIT Lincoln Labs)
PanAmSat Corp.
Satellite Industry Association
SES Americom, Inc.
Telesat Canada

APPENDIX B – Rule Revisions

For the reasons discuss above, the Federal Communications Commission amends title 47 of the Code of Federal Regulations, parts 5, 25, and 97, as follows:

PART 5 – EXPERIMENTAL RADIO SERVICE (OTHER THAN BROADCAST)

1. The authority citation for Part 1 continues to read as follows:

Authority: Secs. 4, 302, 303, 48 Stat. 1066, 1082, as amended; 47 U.S.C. 154, 302, 303. Interpret or apply sec. 301, 48 Stat. 1081, as amended; 47 U.S.C. 301.

2. Add new paragraph (e) to § 5.63 to read as follows:

§ 5.63 Supplementary statements required.

* * * * *

(e) Except where the satellite system has already been authorized by the FCC, applicants for an experimental authorization involving a satellite system must submit a description of the design and operational strategies the satellite system will use to mitigate orbital debris, including the following information:

(1) A statement that the space station operator has assessed and limited the amount of debris released in a planned manner during normal operations, and has assessed and limited the probability of the space station becoming a source of debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal;

(2) A statement that the space station operator has assessed and limited the probability of accidental explosions during and after completion of mission operations. This statement must include a demonstration that debris generation will not result from the conversion of energy sources on board the spacecraft into energy that fragments the spacecraft. Energy sources include chemical, pressure, and kinetic energy. This demonstration should address whether stored energy will be removed at the spacecraft's end of life, by depleting residual fuel and leaving all fuel line valves open, venting any pressurized system, leaving all batteries in a permanent discharge state, and removing any remaining source of stored energy, or through other equivalent procedures specifically disclosed in the application;

(3) A statement that the space station operator has assessed and limited the probability of the space station becoming a source of debris by collisions with large debris or other operational space stations. Where a space station will be launched into a low-Earth orbit that is identical, or very similar, to an orbit used by other space stations, the statement must include an analysis of the potential risk of collision and a description of what measures the space station operator plans to take to avoid in-orbit collisions. If the space station operator is relying on coordination with another system, the statement must indicate what steps have been taken to contact, and ascertain the likelihood of successful coordination of physical operations with, the other system. The statement must disclose the accuracy – if any – with which orbital parameters of non-geostationary satellite orbit space stations will be maintained, including apogee, perigee, inclination, and the right ascension of the ascending node(s). In the event that a system is not able to maintain orbital tolerances, *i.e.*, it lacks a propulsion system for orbital maintenance, that fact should be included in the debris mitigation disclosure. Such systems must also indicate the anticipated evolution over time of the orbit of the proposed satellite or satellites. Where a space station requests the assignment of a geostationary-Earth orbit location, it must assess whether there are any known satellites located at, or reasonably expected to be located at, the requested orbital location, or assigned in the vicinity of that location, such that the station keeping volumes of the respective satellites

might overlap. If so, the statement must include a statement as to the identities of those parties and the measures that will be taken to prevent collisions;

(4) A statement detailing the post-mission disposal plans for the space station at end of life, including the quantity of fuel – if any – that will be reserved for post-mission disposal maneuvers. For geostationary-Earth orbit space stations, the statement must disclose the altitude selected for a post-mission disposal orbit and the calculations that are used in deriving the disposal altitude. The statement must also include a casualty risk assessment if planned post-mission disposal involves atmospheric re-entry of the space station. In general, an assessment should include an estimate as to whether portions of the spacecraft will survive re-entry and reach the surface of the Earth, as well as an estimate of the resulting probability of human casualty.

PART 25 – SATELLITE COMMUNICATIONS

3. The authority citation for Part 25 continues to read as follows:

Authority: 47 U.S.C. 701-744. Interprets or applies Sections 4, 301, 302, 303, 307, 309 and 332 of the Communications Act, as amended, 47 U.S.C. Sections 154, 301, 302, 303, 307, 309 and 332, unless otherwise noted.

4. Add new paragraph (d)(14) to § 25.114 to read as follows:

§ 25.114 Applications for Space Station Authorizations.

* * * * *

(d) * * *

(14) A description of the design and operational strategies that will be used to mitigate orbital debris, including the following information:

(i) A statement that the space station operator has assessed and limited the amount of debris released in a planned manner during normal operations, and has assessed and limited the probability of the space station becoming a source of debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal;

(ii) A statement that the space station operator has assessed and limited the probability of accidental explosions during and after completion of mission operations. This statement must include a demonstration that debris generation will not result from the conversion of energy sources on board the spacecraft into energy that fragments the spacecraft. Energy sources include chemical, pressure, and kinetic energy. This demonstration should address whether stored energy will be removed at the spacecraft's end of life, by depleting residual fuel and leaving all fuel line valves open, venting any pressurized system, leaving all batteries in a permanent discharge state, and removing any remaining source of stored energy, or through other equivalent procedures specifically disclosed in the application;

(iii) A statement that the space station operator has assessed and limited the probability of the space station becoming a source of debris by collisions with large debris or other operational space stations. Where a space station will be launched into a low-Earth orbit that is identical, or very similar, to an orbit used by other space stations, the statement must include an analysis of the potential risk of collision and a description of what measures the space station operator plans to take to avoid in-orbit collisions. If the space station operator is relying on coordination with another system, the statement must indicate what steps have been taken to contact, and ascertain the likelihood of successful coordination of physical operations with, the other system. The statement must disclose the accuracy – if any – with which orbital parameters of non-geostationary satellite orbit space stations will be maintained, including apogee, perigee, inclination, and the right ascension of the ascending node(s). In the event that a

system is not able to maintain orbital tolerances, *i.e.*, it lacks a propulsion system for orbital maintenance, that fact should be included in the debris mitigation disclosure. Such systems must also indicate the anticipated evolution over time of the orbit of the proposed satellite or satellites. Where a space station requests the assignment of a geostationary-Earth orbit location, it must assess whether there are any known satellites located at, or reasonably expected to be located at, the requested orbital location, or assigned in the vicinity of that location, such that the station keeping volumes of the respective satellites might overlap. If so, the statement must include a statement as to the identities of those parties and the measures that will be taken to prevent collisions;

(iv) A statement detailing the post-mission disposal plans for the space station at end of life, including the quantity of fuel – if any – that will be reserved for post-mission disposal maneuvers. For geostationary-Earth orbit space stations, the statement must disclose the altitude selected for a post-mission disposal orbit and the calculations that are used in deriving the disposal altitude. The statement must also include a casualty risk assessment if planned post-mission disposal involves atmospheric re-entry of the space station. In general, an assessment should include an estimate as to whether portions of the spacecraft will survive re-entry and reach the surface of the Earth, as well as an estimate of the resulting probability of human casualty.

* * * * *

5. Revise § 25.143(b)(1) to read as follows:

§ 25.143 Licensing provisions for the 1.6/2.4 GHz mobile-satellite service and 2 GHz mobile-satellite service.

* * * * *

(b) *Qualification Requirements* - (1) *General Requirements.* Each application for a space station system authorization in the 1.6/2.4 GHz Mobile-Satellite Service or 2 GHz Mobile-Satellite Service shall describe in detail the proposed satellite system, setting forth all pertinent technical and operational aspects of the system, and the technical and legal qualifications of the applicant. In particular, each application shall include the information specified in § 25.114. Non-U.S. licensed systems shall comply with the provisions of § 25.137.

* * * * *

6. Remove and reserve § 25.145(c)(3) to read as follows:

§ 25.145 Licensing conditions for the Fixed-Satellite Service in the 20/30 GHz bands.

* * * * *

(c) * * *

(3) [reserved.]

* * * * *

7. Remove and reserve § 25.146(i)(4) to read as follows:

§ 25.146 Licensing and operating authorization provisions for the non-geostationary satellite orbit fixed-satellite service (NGSO FSS) in the bands 10.7 GHz to 14.5 GHz.

* * * * *

(i) * * *

(4) [reserved.]

* * * * *

8. Revise § 25.210(j) to read as follows:

§ 25.210 Technical requirements for space stations in the Fixed-Satellite Service.

* * * * *

(j) Space stations operated in the geostationary satellite orbit must be maintained within 0.05° of their assigned orbital longitude in the east/west direction, unless specifically authorized by the Commission to operate with a different longitudinal tolerance, and except as provided in Section 25.283(b) (End-of-life Disposal).

* * * * *

9. Remove and reserve § 25.217 (d) to read as follows:

§ 25.217 Default Service Rules.

* * * * *

(d) [reserved.]

* * * * *

10. Revise § 25.280 to read as follows:

§ 25.280 Inclined Orbit Operations.

(a) Satellite operators may commence operation in inclined orbit mode without obtaining prior Commission authorization provided that the Commission is notified by letter within 30 days after the last north-south station keeping maneuver. The notification shall include:

(1) The operator's name;

(2) The date of commencement of inclined orbit operation;

(3) The initial inclination;

(4) The rate of change in inclination per year; and

(5) The expected end-of-life of the satellite accounting for inclined orbit operation, and the maneuvers specified under Section 25.283 of the rules.

(b) Licensees operating in inclined-orbit are required to:

(1) Periodically correct the satellite attitude to achieve a stationary spacecraft antenna pattern on the surface of the Earth and centered on the satellite's designated service area;

(2) Control all electrical interference to adjacent satellites, as a result of operating in an inclined orbit, to levels not to exceed that which would be caused by the satellite operating without an inclined orbit;

(3) Not claim protection in excess of the protection that would be received by the satellite network operating without an inclined orbit; and

(4) Continue to maintain the space station at the authorized longitude orbital location in the geostationary satellite arc with the appropriate east-west station-keeping tolerance.

11. Add § 25.282 to subpart D to read as follows:

§ 25.282 Orbit Raising Maneuvers.

(a) A space station authorized to operate in the geostationary satellite orbit under this Part is also authorized to transmit in connection with short-term, transitory maneuvers directly related to post-launch, orbit-raising maneuvers, provided that the following conditions are met:

(1) Authority is limited to those tracking, telemetry, and control frequencies in which the space station is authorized to operate once it reaches its assigned geostationary orbital location;

(2) In the event that any unacceptable interference does occur, the space station licensee shall cease operations until the issue is rectified;

(3) The space station licensee is required to accept interference from any lawfully operating satellite network or radio communication system.

12. Add § 25.283 to subpart D to read as follows:

§ 25.283 End-of-Life Disposal.

(a) *Geostationary orbit space stations.* Unless otherwise explicitly specified in an authorization, a space station authorized to operate in the geostationary satellite orbit under this Part shall be relocated, at the end of its useful life, barring catastrophic failure of satellite components, to an orbit with a perigee with an altitude of no less than:

$$36{,}021 \text{ km} + (1000 \cdot C_R \cdot A/m)$$

where C_R is the solar pressure radiation coefficient of the spacecraft, and A/m is the Area to mass ratio, in square meters per kilogram, of the spacecraft.

(b) A space station authorized to operate in the geostationary satellite orbit under this Part may operate using its authorized tracking, telemetry and control frequencies, and outside of its assigned orbital location, for the purpose of removing the satellite from the geostationary satellite orbit at the end of its useful life, provided that the conditions of subsection (a) are met, and on the condition that the space station's tracking, telemetry and control transmissions are planned so as to avoid electrical interference to other space stations, and coordinated with any potentially affected satellite networks.

(c) *All space stations.* Upon completion of any relocation authorized by subsection (b), or any relocation at end-of-life specified in an authorization, or upon a spacecraft otherwise completing its authorized mission, a space station licensee shall ensure, unless prevented by technical failures beyond its control, that all stored energy sources on board the satellite are discharged, by venting excess propellant, discharging batteries, relieving pressure vessels, and other appropriate measures.

(d) The minimum perigee requirement of subsection (a) shall not apply to space stations launched prior to March 18, 2002.

PART 97 – AMATEUR RADIO SERVICE

13. The authority citation for Part 97 continues to read as follows:

Authority: 48 Stat. 1066, 1082, as amended; 47 U.S.C. 154, 303. Interpret or apply 48 Stat. 1064-1068, 1081-1105, as amended; 47 U.S.C. 151-155, 301-609, unless otherwise noted.

14. Revise § 97.207(g) to read as follows:

§ 97.207 Space station.

* * * * *

(g) The license grantee of each space station must make two written pre-space station notifications to the International Bureau, FCC, Washington DC 20554. Each notification must be in accord with the provisions of Articles S9 and S11 of the ITU Radio Regulations.

(1) The first notification is required no less than 27 months prior to initiating space station transmissions and must specify the information required by Appendix S4 and Resolution No. 642 of the International Telecommunication Union Radio Regulations. The first notification shall also include a description of the design and operational strategies the space station will use to mitigate orbital debris, including the following information:

(i) A statement that the space station operator has assessed and limited the amount of debris released in a planned manner during normal operations, and has assessed and limited the probability of the space station becoming a source of debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal;

(ii) A statement that the space station operator has assessed and limited the probability of accidental explosions during and after completion of mission operations. This statement must include a demonstration that debris generation will not result from the conversion of energy sources on board the spacecraft into energy that fragments the spacecraft. Energy sources include chemical, pressure, and kinetic energy. This demonstration should address whether stored energy will be removed at the spacecraft's end of life, by depleting residual fuel and leaving all fuel line valves open, venting any pressurized system, leaving all batteries in a permanent discharge state, and removing any remaining source of stored energy, or through other equivalent procedures specifically disclosed in the application;

(iii) A statement that the space station operator has assessed and limited the probability of the space station becoming a source of debris by collisions with large debris or other operational space stations. Where a space station will be launched into a low-Earth orbit that is identical, or very similar, to an orbit used by other space stations, the statement must include an analysis of the potential risk of collision and a description of what measures the space station operator plans to take to avoid in-orbit collisions. If the space station operator is relying on coordination with another system, the statement must indicate what steps have been taken to contact, and ascertain the likelihood of successful coordination of physical operations with, the other system. The statement must disclose the accuracy – if any – with which orbital parameters of non-geostationary satellite orbit space stations will be maintained, including apogee, perigee, inclination, and the right ascension of the ascending node(s). In the event that a system is not able to maintain orbital tolerances, *i.e.*, it lacks a propulsion system for orbital maintenance, that fact should be included in the debris mitigation disclosure. Such systems must also indicate the anticipated evolution over time of the orbit of the proposed satellite or satellites. Where a space station requests the assignment of a geostationary-Earth orbit location, it must assess whether there are any known satellites located at, or reasonably expected to be located at, the requested orbital location, or assigned in the vicinity of that location, such that the station keeping volumes of the respective satellites

might overlap. If so, the statement must include a statement as to the identities of those parties and the measures that will be taken to prevent collisions;

(iv) A statement detailing the post-mission disposal plans for the space station at end of life, including the quantity of fuel – if any – that will be reserved for post-mission disposal maneuvers. For geostationary-Earth orbit space stations, the statement must disclose the altitude selected for a post-mission disposal orbit and the calculations that are used in deriving the disposal altitude. The statement must also include a casualty risk assessment if planned post-mission disposal involves atmospheric re-entry of the space station. In general, an assessment should include an estimate as to whether portions of the spacecraft will survive re-entry and reach the surface of the Earth, as well as an estimate of the resulting probability of human casualty.

(2) The second notification is required no less than 5 months prior to initiating space station transmissions and must specify the information required by Appendix S4 and Resolution No. 642 of the Radio Regulations.

APPENDIX C – Final Regulatory Flexibility Analysis

As required by the Regulatory Flexibility Act of 1980, as amended (RFA),[317] an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the Notice of Proposed Rulemaking in the Matter of Mitigation of Orbital Debris (*Orbital Debris Notice*).[318] The Commission sought written public comment on the proposals in the *Orbital Debris Notice*, including comment on the IRFA. The comments received are discussed below. This present Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.[319]

A. Need for, and Objectives of, the Proposed Rules

Orbital debris consists of artificial objects orbiting the Earth that are not functional spacecraft. Since human activity in space began, there has been a steady growth in the number and total mass of orbital debris. The risks presented by orbital debris consist primarily of the risk of collisions between orbital debris and functional spacecraft, and the risk of damage to persons and property on the surface of the Earth in cases where a debris object survives reentry into the Earth's atmosphere. While these risks are small and are likely to remain so for the near term, continued and unmitigated growth in the orbital debris population may limit the usefulness of space – particularly high-value orbits such as low-Earth orbit (LEO)[320] and geostationary-Earth orbit (GEO)[321] – for communications and other uses in the future, by raising the costs and lowering the reliability of space-based systems.

This Second Report and Order adopts rules to minimize the creation of orbital debris by FCC-authorized satellites. Minimizing the creation of orbital debris will help to ensure continued affordable access to space by the United States, the continued provision of U.S. space-based communications, and the continued safety of persons and property in space and on the surface of the Earth. In addition, the adoption of orbital debris mitigation rules by the FCC furthers the long-standing policy of the United States to minimize the creation of orbital debris, and is consistent with international policies and initiatives to mitigate orbital debris.

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[317] *See* 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601 – 612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

[318] *See Mitigation of Orbital Debris*, Notice of Proposed Rulemaking, IB Docket No. 02-54, FCC 02-80, 17 FCC Rcd 5586, 5613 (2002).

[319] *See* 5 U.S.C. § 604.

[320] For purposes of the Second Report and Order, the term LEO is used to refer to the orbits at altitudes below 2,000 kilometers.

[321] GEO is a circular orbit along the plane of the Earth's equator at an altitude of approximately 35,786 kilometers. A spacecraft in geostationary-Earth orbit can be maintained at a constant longitudinal position relative to the Earth, thus allowing the satellite to be "seen" continuously from, and at a fixed orientation to, any given point on the Earth's surface.

B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA

Two parties submitted comments that specifically responded to the IRFA. The Radio Amateur Satellite Corporation (AMSAT)[322] contends that it and its constituent members qualify as "small entities" that must be considered in the Commission's formulation of any new rules that may be applicable to the amateur-satellite service. In addition, the University of Mississippi National Remote Sensing and Space Law Center (UM Space Law Center)[323] proposes that, although threshold requirements for orbital debris mitigation should be set by the FCC, the orbital debris mitigation plans of small entities should be reviewed on a case-by-case basis and that small entities should be able to seek exemptions from orbital debris mitigation reporting or compliance requirements if specific reasons for the exemption can be shown.

There is no significant economic impact on AMSAT or its constituent members under the RFA. AMSAT is a non-profit scientific and educational organization that represents individuals who hold amateur radio licenses under Part 97 of the FCC rules, 47 C.F.R. § 97, and who operate or communicate with amateur space stations. Because only individuals may hold amateur licenses and amateur licensees are precluded from operating for commercial purposes, neither AMSAT nor individual amateur licensees fit the definition of small entity, as defined by the SBA.[324] Nonetheless, the Second Report and Order has addressed the proposal of AMSAT and other commenters to exempt categorically amateur space stations from orbital debris mitigation requirements and found such proposals to be inconsistent with the purpose and object of such requirements.[325]

Furthermore, the rules adopted in the Second Report and Order are consistent with the proposals of the UM Space Law Center. Under the new rules, the elements of the orbital debris mitigation plans of all parties – not just small entities – are reviewed on a case-by-case basis in the majority of instances. Where the rules adopt rules in lieu of case-by-case review, such as for the post-mission disposal of GEO satellites, parties are permitted under existing FCC rules to seek waivers of such requirements for specific good cause shown.[326] In addition, the Second Report and Order exempts, or "grandfathers," in-orbit GEO satellites that were launched prior to the release of the *Orbital Debris Notice* on March 18, 2002 from the minimum post-mission disposal altitude requirement that are adopted by the Commission.[327] Comments indicated that the financial impact of the post-mission disposal rules for GEO spacecraft would be greatest for this class of satellites, including any that may be operated by small entities.

C. Description and Estimate of the Number of Small Entities to Which the Proposed Rules May Apply

The RFA directs agencies to provide a description of, and, where feasible, an estimate of, the number of small entities that may be affected by the proposed rules, if adopted.[328] The RFA generally

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[322] Comments of the Radio Amateur Satellite Corporation Regarding Initial Regulatory Flexibility Analysis, IB Docket No. 02-54 (filed July 17, 2002).

[323] Response of the University of Mississippi National Remote Sensing and Space Law Center to Initial Regulatory Flexibility Analysis, IB Docket No. 02-54 (filed July 16, 2002).

[324] *See* 5 U.S.C. § 601(6) ("small entity" has same meaning as "small business" under RFA).

[325] *See Second Report and Order* at paras. 89-92.

[326] *See* 47 C.F.R. § 1.3.

[327] *See Second Report and Order* at Section III.D.4.i.

[328] 5 U.S.C. § 603(b)(3).

defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[329] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[330] A small business concern is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA).[331] A small organization is generally "any not-for-profit enterprise which is independently owned and operated and is not dominant in its field."[332] Nationwide, as of 1992, there were approximately 275,801 small organizations.[333] "Small governmental jurisdiction" generally means "governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than 50,000."[334] As of 1992, there were approximately 85,006 such jurisdictions in the United States.[335] This number includes 38,978 counties, cities, and towns; of these, 37,566, or 96 percent, have populations of fewer than 50,000.[336] The Census Bureau estimates that this ratio is approximately accurate for all governmental entities. Thus, of the 85,006 governmental entities, we estimate that 81,600 (91 percent) are small entities. Below, we further describe and estimate the number of small entity licensees that may be affected by the proposed rules, if adopted.

The rules proposed in this Second Report and Order would affect satellite operators, if adopted. The Commission has not developed a definition of small entities applicable to satellite operators. Therefore, the applicable definition of small entity is generally the definition under the SBA rules applicable to Satellite Telecommunications.[337] The SBA has developed a small business size standard for Satellite Telecommunications, which consists of all such firms having $12.5 million or less in annual receipts.[338] According to Census Bureau data for 1997, in this category there was a total of 324 firms that operated for the entire year.[339] Of this total, 273 firms had annual receipts of under $10 million, and an additional twenty-four firms had receipts of $10 million to $24,999,999.[340] Thus, under this size standard, the majority of firms can be considered small.

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[329] *Id.* § 601(6).

[330] 5 U.S.C. § 601(3) (incorporating by reference the definition of "small business concern" in 15 U.S.C. § 632). Pursuant to the RFA, the statutory definition of a small business applies "unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register." 5 U.S.C. § 601(3).

[331] Small Business Act, 15 U.S.C. § 632 (1996).

[332] 5 U.S.C. § 601(4).

[333] 1992 Economic Census, U.S. Bureau of the Census, Table 6 (special tabulation of data under contract to Office of Advocacy of the U.S. Small Business Administration).

[334] 5 U.S.C. § 601(5).

[335] U.S. Dept. of Commerce, Bureau of the Census, "1992 Census of Governments."

[336] *Id.*

[337] "This industry comprises establishments primarily engaged in providing point-to-point telecommunications services to other establishments in the telecommunications and broadcasting industries by forwarding and receiving communications signals via a system of satellites or reselling satellite telecommunications." Small Business Administration, 1997 NAICS Definitions, NAICS 513340.

[338] 13 C.F.R. § 121.201, NAIC code 517410 (changed from 513340 in October 2002).

[339] U.S. Census Bureau, 1997 Economic Census, Subject Series: Information, "Establishment and Firm Size (Including Legal Form of Organization)," Table 4, NAICS code 513340 (issued October 2000).

[340] *Id.*

In addition, Commission records reveal that there are approximately 240 space station operators licensed by this Commission. We do not request or collect annual revenue information, and thus are unable to estimate of the number of licensees that would constitute a small business under the SBA definition. Small businesses may not have the financial ability to become space station licensees because of the high implementation costs associated with satellite systems and services.

D. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements

Under the rules as amended by the Second Report and Order, a satellite system operator requesting FCC space station authorization, or an entity requesting a Commission ruling for access to a non-U.S.-licensed space station under the FCC's satellite market access procedures, must submit an orbital debris mitigation plan to the Commission regarding spacecraft design and operation in connection with its request. The Second Report and Order provides guidance for the preparation of such plans. The Second Report and Order also adopt requirements concerning the post-mission disposal of Commission-licensed space stations operating in or near the two most heavily used orbital regimes, low-Earth orbit and geostationary-Earth orbit.

As discussed below in Section E, all parties requesting Commission authorization to operate a space station or a ruling for access to a non-U.S.-licensed space station must already demonstrate under existing FCC rules that they have the technical and legal ability to conduct such operations as a prerequisite to grant of an FCC authorization.[341] Because the preparation and disclosure of orbital debris mitigation plans utilizes the same engineering and legal resources as those used for space station operations, it is expected that all parties – including small entities – will have the resources to prepare and disclose orbital debris mitigation plans.

E. Steps Taken to Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered

The RFA requires an agency to describe any significant alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities.[342] Each is discussed in turn below.

(1) *Differing compliance or reporting requirements.* The Second Report and Order requires all satellite operators to disclose plans to mitigate orbital debris as part of their requests for Commission authorization. The timetable for the disclosure of orbital debris mitigation plans is tied to submission of a request for Commission licensing or authorization, the timing of which is subject to the control of the applicant. As a result, the timetable for the disclosure can be adjusted by any applicant – including small entities – without the need for specific exemptions in the Commission's rules. In addition, differing compliance requirements for small entities are unnecessary because all parties requesting Commission authorization to operate a space station or a ruling for access to a non-U.S.-licensed space station must

[341] 47 C.F.R. § 25.140-146 (requiring applicants in various satellite services to demonstrate technical qualifications as a prerequisite to receiving Commission authorization for space station operations).

[342] 5 U.S.C. § 603(c)(1) – (c)(4).

already demonstrate under existing FCC rules that they have the technical and legal ability to conduct such operations as a prerequisite to grant of an FCC authorization.[343] Because the preparation and disclosure of orbital debris mitigation plans utilizes the same engineering and legal resources as those used for space station operations, it is expected that all parties – including small entities – will have the resources to prepare and disclose orbital debris mitigation plans. Furthermore, authorizing space station operations by small entities, which pose the same public interest concerns as those posed by large entities, without any consideration of whether the proposed space station operations will contribute unreasonably to the creation of orbital debris would undermine the policy object of the Commission and the United States Government in mitigating orbital debris.

(2) *Clarification, consolidation, or simplification of compliance or reporting requirements.* The Second Report and Order clarifies, consolidates, and/or simplifies several existing compliance or reporting requirements regarding the operation of FCC-licensed space stations that will benefit all authorized space station operators, including small entities.

(3) *Use of performance, rather than design, standards.* The Second Report and Order establishes its debris mitigation requirements in terms of performance standards and does not adopt design standards for any class of entities, including small entities.

(4) *Exemption from coverage of the rule, or any part thereof, for small entities.* Authorizing space station operations by small entities, which pose the same public interest concerns as those posed by large entities, without any consideration of whether the proposed space station operations will contribute to the creation of orbital debris would undermine the policy object of the Commission and the United States Government in mitigating orbital debris. A categorical exemption from debris mitigation rules was considered in the context of amateur space station licenses – even though amateur space station licensees are not small entities as defined by the RFA – and was rejected as inconsistent with the underlying purpose of the rules.[344] In addition, any operator – including a small entity – is permitted under existing FCC rules to seek waivers of debris mitigation requirements for specific good cause shown.[345] In addition, the Second Report and Order exempts, or "grandfathers," all in-orbit GEO satellites that were launched prior to the release of the *Orbital Debris Notice* on March 18, 2002 from the minimum post-mission disposal altitude requirement that are adopted by the Commission.[346] Comments indicated that the financial impact of the post-mission disposal rules for GEO spacecraft could be significant for this class of satellites in the absence of grandfathering.

F. Federal Rules that May Duplicate, Overlap, or Conflict With the Proposed Rules

Remote sensing satellite systems are licensed by both the FCC and the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce. The Second Report and Order waives disclosure requirements concerning post-mission disposal of spacecraft for remote sensing satellites when those disposal plans have been reviewed and approved by NOAA as part of its licensing process.

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[343] 47 C.F.R. § 25.140-146 (requiring applicants in various satellite services to demonstrate technical qualifications as a prerequisite to receiving Commission authorization for space station operations).

[344] *See Second Report and Order* at para. 91.

[345] *See* 47 C.F.R. § 1.3.

[346] *See Second Report and Order* at Section III.D.4.i.

G. Report to Congress

The Commission will send a copy of the Second Report and Order, including this FRFA, in a report to be sent to Congress pursuant to the Congressional Review Act.[347] In addition, the Commission will send a copy of the Second Report and Order, including this FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of the Second Report and Order and FRFA (or summaries thereof) will also be published in the Federal Register.[348]

[347] *See* 5 U.S.C. § 801(a)(1)(A).

[348] *See* 5 U.S.C. § 604(b).